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(54) IMPROVEMENTS IN OR RELATING TO MARINE DIESEL ENGINES

(71) We, HYDROCONIC LIMITED, a British Company of Worting House, Basingstoke, Hampshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to marine diesel engines, and especially such engines employed as the propulsion plant in tug boats.

It is a feature of most medium and high speed diesel engines fitted with exhaust turbine superchargers that their so-called turn down speed, namely the lowest speed from which they can recover revolutions on light load, is quite high and much higher than idling speed.

The reason for this arises out of the fact that in engines fitted with exhaust turbine driven superchargers the exhaust gas discharge drives the gas turbine which in turn is coupled to the blower that increases the mass charge of air to the engine. On light load the gas turbine does not receive enough exhaust gas to drive it and hence the roles of turbine and blower are reversed, the blower in the intake manifold acting to retard the intake air, thus deriving energy which tends to drive the gas turbine. Thus, the presence of the exhaust gas turbine blower in such engines is actually detrimental to the recovery under light load of the engine from low revolutions.

In the case of tugs this is particularly disadvantageous because the thrust derived from the propelling device, for example the propeller or propellers, or the screw or screws, is directly proportional to the square of the revolutions of said propelling device. If the turn down speed is 50% of the engine speed at full blower revolutions, the bollard pull will be one-quarter of maximum, and if the turn down speed is 25%, the pull will be one sixteenth.

In the case of a 40 ton bollard pull tug, a 50% turn down speed will give a minimum bollard pull of 10 tons and a 25% turn down speed a minimum bollard pull of 2½ tons. 40 tons is a practicable bollard pull for a tub and often used. 10 tons is altogether too high as a minimum bollard pull and would require a subsidiary control device such as a controllable pitch propeller, multi-speed gearbox or some sort of fluid coupling or similar device to reduce the minimum speed of the propellers. 2½ tons on the other hand is quite manageable and satisfactory.

It is an object of the invention to provide a marine diesel engine which, when installed in a propulsion plant of a tug using diesel engines fitted with exhaust turbine driven superchargers and in the absence of any variable speed connection between the engine and the propeller will enable a minimum bollard pull which is practicable and usable in relation to the maximum bollard pull to be achieved.

According to the present invention, a marine diesel engine is provided with an exhaust-turbine-driven supercharger for supplying air to the engine through an engine air intake manifold, and further comprises an electrically-driven auxiliary fan or blower deriving its electrical supply from an electrical generator and discharging into the intake manifold downstream of the supercharger, said auxiliary fan or blower being inoperative during normal speed running of the engine and means being provided to start up the auxiliary fan or blower when the engine speed falls below a pre-selected speed, and to stop the auxiliary fan or blower when the engine speed rises above said pre-selected speed. Conveniently, the pre-selected engine speed at which the auxiliary blower starts may be a little above turn-down speed. For example, suppose that a turn down speed of 50% of the engine speed is characteristic of a given engine, then at say, 55% of maximum revolutions extra intake manifold air will begin to be supplied from the auxiliary blower, this being sufficient to enable the revolutions of the engine to be brought up even though a propeller load is connected thereto.

One way of carrying the invention into

practice is shown by way of example in the accompanying drawing, which is a side elevation of a medium/high speed marine diesel engine.

The drawing shows an electrical generator 11 driven from the main engine 12, or alternatively it could be driven from an auxiliary prime mover, this generator 11 being used to supply power to an electrically driven auxiliary blower or fan 13 which starts up and discharges into the engine air intake manifold 14 through a valve 15 when the pre-selected speed is reached as the main engine speed falls toward the turn-down speed. The subsidiary air inlet is situated downstream of an exhaust turbine-driven supercharger 16 for the engine and the valve 15 opens automatically when the auxiliary blower is operating. The supply of air into the manifold from both blowers 13 and 16 thus increases the mass charge and improves the recovery characteristics of the engine from low revolutions.

The subsidiary blower or fan 13 is not needed above the preselected speed. The means for shutting down this blower or fan may be either mechanical, e.g. a centrifugal or similar cut-out device which may operate a relay, or, in the case of the engine-driven generator 11 as shown, a voltage control system responsive to a tachometer generator 17 which automatically cuts out the excitation of the generator 11 when the pre-selected engine speed is exceeded.

Where more than one marine engine is coupled to a common propeller shaft, the electrical generator may be gearbox driven from either or both of the engines, or alternatively an individual generator may be fitted to each of the engines. It is also possible to employ a blower system in which the electrical generator is driven by auxiliary machinery. It is usually not sufficient to fit an electrically driven blower to only one engine of a pair driving a common shaft because it is unlikely that the recovery characteristics of one engine alone will be adequate; the torque absorbed by the propeller will probably stall the single engine unless a large quantity of subsidiary air is provided by the electrically driven blower. While it may be feasible to provide such a quantity of air, the probability is that this will be found to be an uneconomic solution in the general case.

The invention, as stated earlier, is particularly applicable to tug boats, especially where large fixed-pitch propellers are fitted without hydraulic couplings or multi-speed gearboxes.

WHAT WE CLAIM IS:—

1. A marine diesel engine, provided with an exhaust-turbine-driven supercharger for supplying air to the engine through an engine air intake manifold, and further comprising an electrically-driven auxiliary fan or blower deriving its electrical supply from an electrical generator and discharging into the intake manifold downstream of the supercharger, said auxiliary fan or blower being inoperative during normal speed running of the engine and means being provided to start up the auxiliary fan or blower when the engine speed falls below a pre-selected speed and to stop the auxiliary fan or blower when the engine speed rises above said pre-selected speed.

2. An engine according to Claim 1, wherein a mechanically-operated relay is provided to shut down the auxiliary fan or blower automatically when the engine revolutions rise above the pre-selected speed.

3. An engine according to Claim 1, wherein the generator is provided with a voltage control system responsive to a tachometer-generator for removing the generator excitation automatically when the engine revolutions rise above the pre-selected speed.

4. A marine diesel engine substantially as described with reference to and shown in the accompanying drawing.

5. A tug boat equipped with an engine according to any one of the preceding claims.

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1437171 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*